Investigation of fraudulent arson involving a racing car

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Introduction

Mr Andrew Bramley was an unfortunate man. Two high value sports cars had caught fire. His racing Ferrari Marinello was damaged, apparently, in a road accident. Then, when he left his Porsche in Liverpool to get help to change his flat tyre, the car was stolen. Not all his stories ran true, however, so they came to the attention of Derbyshire Constabulary's CID, based at Chesterfield.

The dedicated investigations of DC Loftus and DC Carrington revealed that there was more of the unscrupulous than the unlucky about Mr Bramley. A pattern emerged of obtuse finances and obscure insurance claims but the European Court of Human Rights had ruled that if all the cases were heard together the evidence against Bramley would be overwhelming and that would be unfair. Each case by itself, however, held insufficient evidence to be certain of conviction, and the early ones, before suspicions had been aroused, suffered from a lack of thorough investigation. And then his Lotus Esprit GT high performance racecar caught fire just as he was due to return it to the finance company, causing a half million pounds worth of damage in a Mercedes garage in Sheffield.

Bramley had set up a 'virtual' company of race car constructors called GTR Engineering. By providing his own manufacturing certificates he was able to register race vehicles as road cars then using that 'proof' of identity, apply to finance companies to purchase the race cars under his own name from GTR Engineering. The loans were secured using his family's restaurant business, indeed, one deal was finalised on the set of a TV cookery programme, yet nobody from the licensing office nor the finance companies had ever inspected the vehicles. In this way he claimed to have three racecars but in reality he had only two. In fact, Lotus only ever made three cars to this GT race specification.

His racing programme was not successful and debts began to mount, one of the cars having been damaged beyond repair. The financiers demanded that one of the cars be returned but he persuaded them that they should first give him some more money to restore the car to full race condition in order to increase its value. They bowed to his charm and agreed. The car was taken to a garage in Sheffield where he was granted workshop facilities. The car was due to be tested on a track on 12 September 1998 but caught fire at around 04:50 that day while Bramley was working on it alone.

Staff at the garage were suspicious of Bramley and called South Yorkshire Police who made a brief investigation but came up with nothing conclusive. The liability insurers of the garage appointed a forensic investigation that was conducted by the author of this paper. It was concluded that the fire originated within the Lotus car but the precise cause could not be given at that stage. As no liability rested with the garage, no further action was required by their insurers.

Meanwhile, news of this latest twist of Bramley's fate reached Derbyshire Constabulary. Detectives Loftus and Carrington immediately sought advice from experts in the race car industry. While showing to them photographs taken by scene of crime officers it was suggested that a fuel pipe might have been removed. In July 2000 Detectives Loftus and Carrington visited the author, whose photographs were the earliest to be taken after the fire. It seemed that the fuel pipe was missing immediately after the fire. The author asked to see Bramley's statement but the latter had refused to make any comment during interviews with the Police. He had, however, produced a signed statement of his own in which he had said.

> "I finished clearing up and tried to complete my notes ..... There was a small flare up in the hot engine bay of un-burnt fuel or vapour. It was possibly consistent with ignition of the fuel vapour in the exhaust system or the hot manifolds. I had my head down in the engine bay fitting the air box so I caught the flare up in my face..."

This did not ring true. Where had the vapour come from? Why had it not dispersed? What could have ignited the vapours? Further investigation was required.

Method

The ideal way to investigate the cause of fire in a car is to have one of the same type available for inspection. Detectives Loftus and Carrington had traced the remaining Esprit GT racer (Lotus only made three of that type) to Mike Haines Racing in Worcestershire. Mr Haines was willing to assist with enquiries and provide a comparison vehicle (Figure 1).

Key words Forensic science, arson, fire investigation, racing car, fraud, multi-agency co-operation.

Figure 1 Nearside of comparison vehicle belonging to Mike Haines Racing.

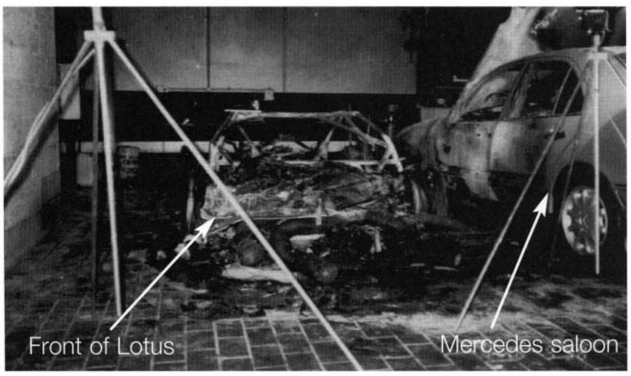
While a good understanding of physical and some chemical science is essential for fire investigation, there is very little that can be done analytically to determine the point of origin of a fire. The important maxim is that employed by the earliest scientists – controlled observation. Look, think and look again. Compare what you see with what you expect to see from your understanding of the control specimen and from whatever fires you have seen in the past. Reiterate the process until a pattern of fire spread becomes apparent. Find fresh control data when queries arise and iterate again.

Once your imagination (the single most important tool of a fire investigator) can recreate a sequence of events that provides answers, challenge it with fresh theories. If the alternatives can be discounted then you can be confident in your postulate. It is then necessary to affirm your views with as much data as you can collect.

The first task was to determine the arrangement and combustibility of materials within the engine bay. The car had caught fire in a closed workshop and the 'bonnet' had been removed at the time (Figure 2). The fire would have been ventilated by free convection so the fuel loading would have been the primary influence on the development of the fire.

The layout of the engine bay was very simple compared to a 'domestic' motor car (Figure 3). There was no plastic air filter housing, no plastic oil drip tray or engine cover, no power steering gear nor large washer bottles. There was simply an aluminium engine block with aluminium air circuit components,

Figure 2 The Mercedes garage where the Lotus was being prepared for track testing.



steel exhaust and steel turbochargers. Comparison with photographs of the fire damaged vehicle (which had by then been scrapped) confirmed immediately that the engine and turbo charger arrangements were the same type. The comparison vehicle was therefore an ideal control specimen.

In this instance it was necessary to understand how easy it would be for the bodywork to ignite from a flash fire involving petrol vapours, and how the bodywork would then burn. Glass reinforced plastic, or 'fibreglass' was used in the construction of upper body panels and carbon fibre for the floorpan and some more structural members. Empirical tests using a blowtorch showed that fibreglass required persistent flame contact in order for the binding resin to ignite. If oblique, flame contact was required for about seven seconds but only a couple of seconds' contact was required on the edges to cause ignition. Once ignited, the fibreglass resin would burn steadily.

Carbon fibre resin required persistent flame presence to burn and was soon consumed. When the blowtorch was moved away, the flames extinguished themselves (Figure 4). Hence it was established that any ignition of leaked petrol vapours would have to be sustained for around five seconds and would have to have played directly onto fibre glass in order for the fire to catch hold. So where was the leak?

The bodywork of the car had burned to completion but aluminium components of the engine displayed clearly discernable patterns of directional heating (Figure 5). Care had to be taken when interpreting melting patterns to understand the thickness of the melted components and any heat sink effect of thick castings or steel components nearby.

After much comparison of the photographs of the fire damaged car with the 'live' example it could be seen from the melting of fuel manifolds, air boxes and oil reservoirs that the fire had originated at low level between the engine and gear box, but not at such a low level as to affect the bottoms of tyres (Figures 6 and 7).

It could be seen from comparison that the air entry and the exhaust gas systems were in place at the time of the fire thus

Figure 3 Engine bay of comparison vehicle.

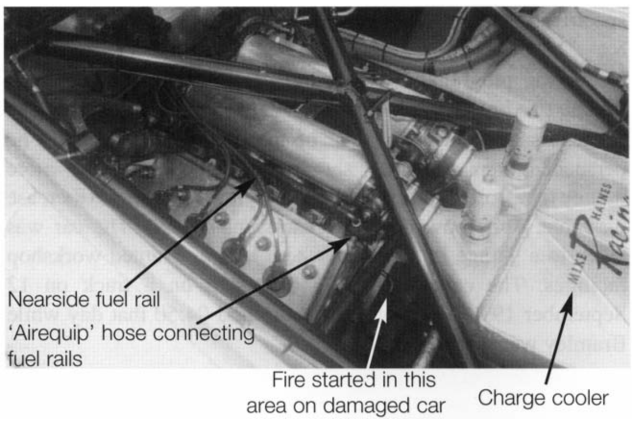


Figure 4 Empirical test of combustibility of carbon fibre.

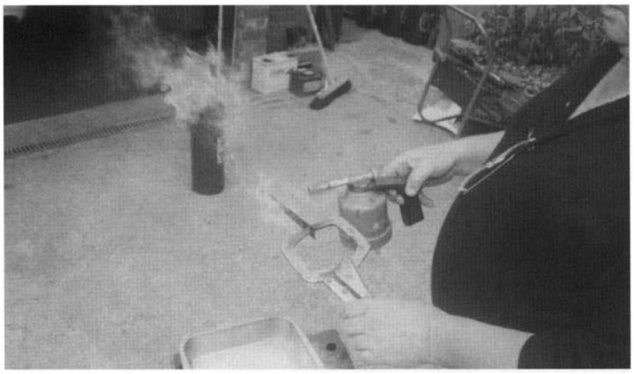
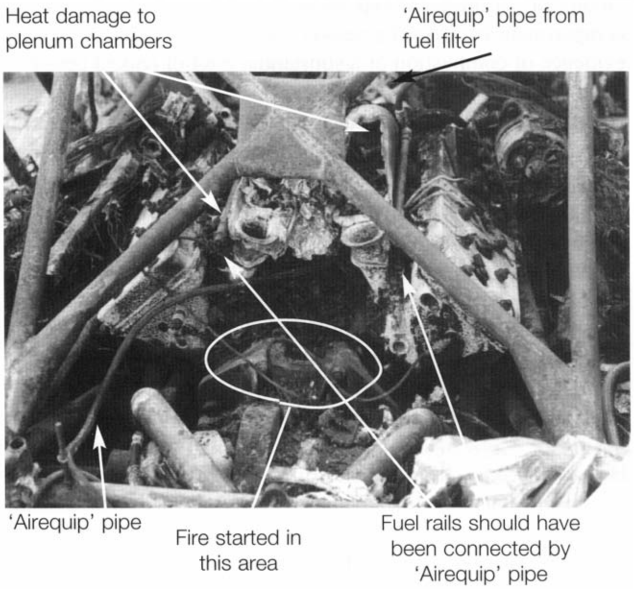


Figure 5 Damage to engine.



reducing greatly the likelihood of a 'blowback' of burning fuel having escaped. Instead it appeared that there had to have been a leakage of liquid fuel.

The fuel delivery system was pressurised even when the engine was switched off so any crack in a pipe would have led to vapour and aerosol releases. The nearest fuel system component to the apparent seat of fire was a flexible hose that joined two pipes, one either side of the engine, that delivered petrol to solenoid operated inlet valves. No trace of the pipe could be found on photographs of the fire damaged car. The pipe was of an 'Aerequip' design commonly found in aircraft applications where reliability is essential in extremes of temperature and vibration, even to limited exposure to fire.

The hose comprised aluminium alloy unions coupled by high temperature resistant rubber hose sheathed in stainless steel braiding. Similar hoses were used in the lubricating oil system in areas where, as indicated by melting of aluminium components,

Figure 6 Damage to rear of engine. Larger arrows show direction of fire spread.

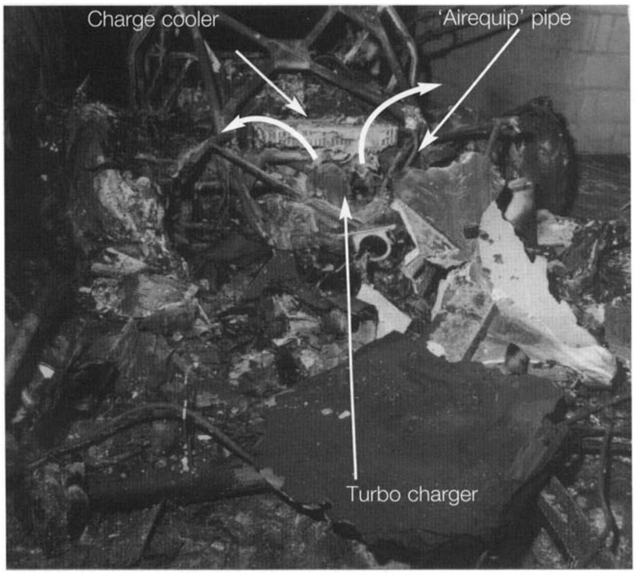
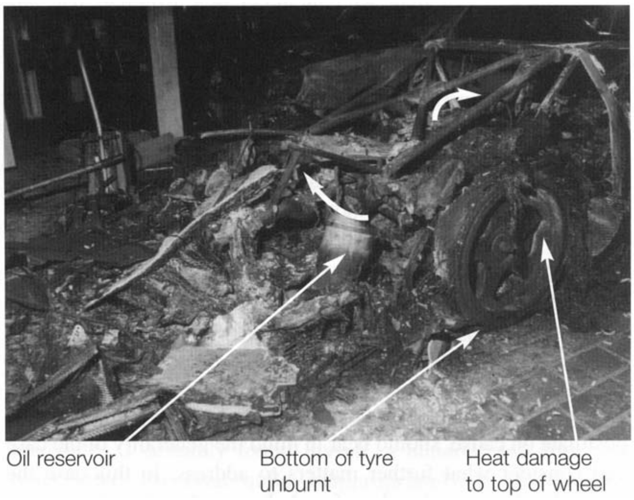


Figure 7 Damage to rear of car. Larger arrows show direction of fire spread.



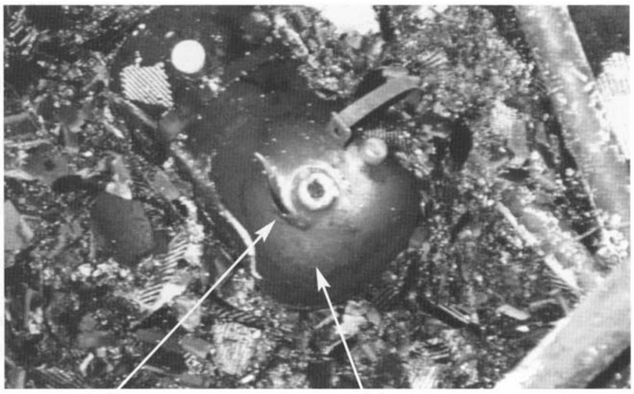
they had been exposed to similar localised temperatures as the rear of the engine. They had survived. So too should the fuel interconnector.

So it would seem that a section of fuel line had been removed before the fire but it might be said that this was left off accidentally so it was still necessary to consider how ignition could occur. The area of origin of the fire, and a reasonable distance from the leak where a flammable concentration of vapour could be expected, contained no electrical apparatus that would have created sparks or was likely to have generated sufficient heat to ignite petrol vapours.

Consideration was therefore given to hot surface ignition from components in the exhaust system; especially the turbocharger.

Figure 8 Fuel cell had collapsed in the same way as an empty bag in a wine box.

Figure 9 Damage to fire extinguishant reservoir.



Measurements of surface temperature were made at several positions in the engine bay but the test was terminated after ten minutes, long before steady state conditions had been reached and when the highest surface temperature was only 98°C. This was because the engine relied upon forward movement of the car to draw sufficient air over its water coolant radiators to keep it cool. When stationary, the engine would overheat after being run for more than ten minutes. Although not specified in his statement it could then be concluded that Bramley was not running the engine at the time of the fire as that would have required constant attention to the temperature gauge. He could not have been "...cleaning up and trying to complete my notes...".

There could have been no hot surface for ignition even with the engine running but with it not running, nor could there be any possibility of flame-back through the air circuit or spark ignition from the engine management system. Hence it was reasonable to conclude that the fire was caused by Mr Bramley using a naked flame to ignite a substantial leak of petrol caused by his removal of the link pipe in the fuel system.

At this point the fire investigator, having reached a reasonable postulate on cause, should bear in mind the generality of the case and consider what further matters to address. In this case the principle charges related to fraud. It was therefore important, perhaps more so, to find evidence that contradicted Bramley's statement, rather than simply proving the cause of the fire, as this would demonstrate his intention to deceive. There were three examples.

Bramley had claimed that mechanics at the garage where he was working on the car had helped him re-refuel the car ready for testing the next day. There was no doubt that the mechanics had obtained the fuel for him but examination of the fuel tanks after the fire revealed that they were almost empty (Figure 8). Information obtained from the fuel tank manufacturers suggested that the woven nylon/polymer matrix fuel cells should have survived the fire. Re-examination of photographs of the fire damage showed that the fire had been reasonably confined to the "footprint" of the car except where it had spread into the engine compartment of a nearby saloon car (Figure 2). There was no evidence of combustion of a substantial pool of leaked petrol.

Bramley mentioned in his statement that he operated the car's on board fire extinguisher but it failed to extinguish the flames. Had he done so the extinguishant reservoir would have been depressurised and would have remained open to atmosphere. It could not have swelled and ruptured in the heat of the fire (Figure 9).

The car was fitted with a Motec engine management system. These are rare and valuable. Bramley sold one such system after the fire. Photographs of the fire damaged vehicle showed no remnant of the system at the location where it should have been.

Hence not only had the cause of the fire been reasonably established but so too had evidence of Bramley's deceptions. All that remained was to gather supportive evidence for the trial including: confirmation from Lotus regarding the maximum operating temperatures of the engine when the car was stationary; technical specifications of the Aerequip pipes regarding their heat endurance; a technical specification and operating manual for the fire extinguisher system; calculations of pool sizes for leakage of the supposed contents of the fuel tanks.

Also we considered examination of an engine management system controller to demonstrate what should have remained after a fire. This was not necessary, however, because when faced with the findings from the forensic examinations, Mr Bramley confessed to all his crimes. He received a four year jail sentence.

Acknowledgements
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